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Signed J Evans.

Dated 2 February 2001

Patents Form 1/77

Patents Act 1977
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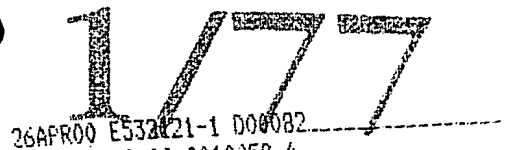
The Patent Office



Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

25 APR 2000

The Patent Office
Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference
XIAOBAO CHEN

2. Patent application number
(The Patent Office will fill in this part)
0010059.4

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*
Lucent Technologies Inc.
600 Mountain Avenue,
Murray Hill,
New Jersey 07974-0636,
United States of America

Patents ADP number *(if you know it)*
73498148001

If the applicant is a corporate body, give the country/state of its incorporation
Delaware/U.S.A.

4. Title of the invention
SUPPORTING IP ON ABIS INTERFACE

5. Name of your agent *(if you have one)*
D.J. WILLIAMS

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*
Lucent Technologies UK Limited,
5 Mornington Road,
Woodford Green,
Essex IG8 OTU,
England

Patents ADP number *(if you know it)*
6993869001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	6 + 6
Claim(s)	
Abstract	
Drawing(s)	

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature

Date 25.4.00

12. Name and daytime telephone number of person to contact in the United Kingdom

D.J. WILLIAMS 020 8504 2824

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) For details of the fee and ways to pay please contact the Patent Office.

Supporting IP on Abis Interface

Draft 0.1

Xiaobao Chen

19 April 2000

1. Assumptions

The technical details are based on existing ETSI GSM/GPRS specifications such as GSM 03.60, 08.51, 52, 54, 56, 58 . References to all non-GSM specifications will be explicitly stated where such references are made.

Supporting IP on Abis includes two aspects about which clear distinctions should be made.

- Using IP as the accessing mechanism/protocol

  IP is used to identify the traffic source and the destination and the user data traffic/information is carried in payload of IP packets that will then be routed to the required destination as indicated by the destination address. The routing protocol may be IP or non-IP such as ATM.

- Using IP as the network routing mechanism/protocol.

  IP is used as the routing protocol to route IP packets across the network (between hops/networks nodes across the network link. In this scenario, IP is used as the network layer routing protocol that is responsible for delivering the IP packets across the network to the destination. This scenario also explicitly excludes the use of ATM as the routing/switching mechanism.

Without losing the generality, the following discussions shall be based on the assumption of using IP as the accessing mechanisms/protocol. This implies that the underneath network links or the routing/switching mechanisms may well be non-IP such as ATM.

2. Confirm that the Internet Protocol shall be entirely compliant with the RFC 791 Standard (V4) or RFC 791 Standard (V6).

The technical discussions that follows about supporting IP based Abis mean to apply to both IPv4 and IPv6. Any possible compatibility issues that may exit between IPv4 and IPv6 shall be explicitly stated.

3. The protocol stack supporting IP at the Abis interface.

An protocol stack that deploys IP as the access/transport bearer for the layer 3/2 message exchanges between the BSC and the BTS is shown in Figure 1.

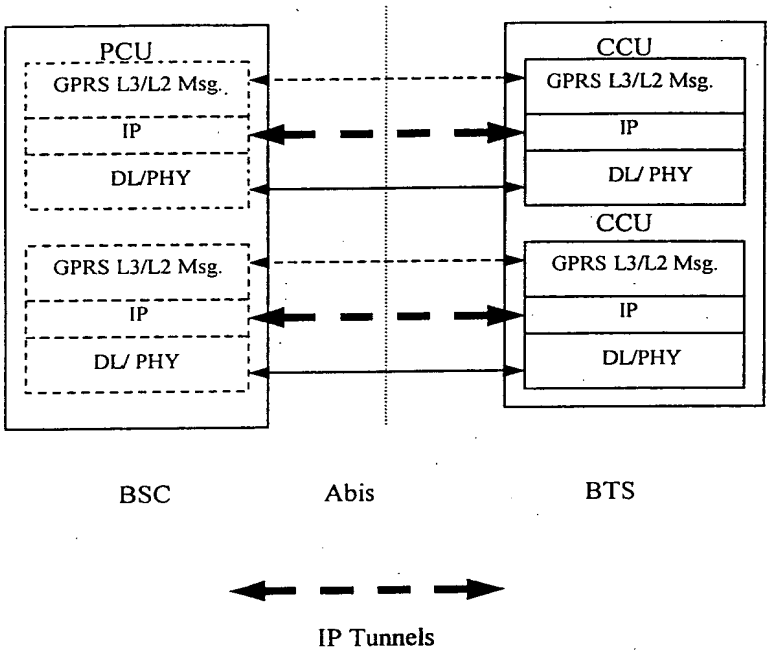


Figure 1. IP tunnelling of layer 2 Messages over Abis interface

Figure 1 depicts the option of locating PCU in the BSC. IP is used as the access as well as the transport bearer to tunnel the Layer 2 messages between the BSC and the BTS over the Abis interface.

Alternatively, the TCP/IP or UDP/IP is used for both information exchanges over the traffic channels and the signalling channels.

4. Detail any proprietary extensions to the IETF Standard Protocol

For the approach that uses IP tunnelling, possible propriety extensions to the IETF standard protocol include the addition of an extra field, Abis Message Type Field, to indicate the Abis layer3/2 message type.

No proprietary extensions are expected for the alternative approach that uses TCP/IP or UDP/IP.

5. Detail how IP is used in the separation of Transport from signalling and Control.

When the approach of IP tunnelling is used, the signalling and data messages are multiplexed over the same IP tunnel that provides the "point-to-point" connectivity between the BTS and the associated BSC. At the receiving side, either at the BTS (for the downlink) or the BSC (for the uplink), the tunnelled Abis messages are de-multiplexed by indexing the Abis Message Type Field .

Different processing and handling priorities can be achieved by filtering the corresponding field(s) in the IP header.

5. Detail how the interface is used to support codes and channels allocation/de-allocation.

The selection and allocation of appropriate code and channels shall be based on packet handling priority information contained in the IP header and the Abis Message Type Field.

The successful set-up of an RR session will activate an active "IP tunnel" associated with a specific set of code and channels that have been allocated. The necessary status record is set up corresponding to the IP tunnel.

De-allocation of a channel will deactivate an existing active IP tunnel and the associated status recorded will be deleted.

The timing control during the mapping between the traffic channels on the radio path and the terrestrial traffic channels is for further study.

6. Explain how IP is used to support radio resource handover

No handover recognition or decision is made by BTS. Once the handover decision is made, the BSC issues an IP tunnel set-up command to the new BTS (for intra-BSC handover) and subsequently passes all the information related to the MS to the new BTS. After setting up a new IP tunnel to the new BTS, the BSC issues an IP tunnel close command to close the old IP tunnel associated with the MS that has just performed the handover.

The Radio Channel management and the terrestrial channel management are controlled by the BSC. No changes are expected over the existing control procedures.

7. Explain how IP is used to support inter technology handover (e.g. EDGE to W-CDMA).

A unified connectivity using IP tunnelling between the BTS and the BSC of EDGE and the Node B and the RNC of UMTS facilitates the handover control between EDGE and UMTS. This is largely because the connectivity that is frequently switched on and off during the handover is achieved and maintained by the simple stateless IP accessing and routing mechanism that is independent of the underlying link layer control and transport mechanisms. As a result, it can dramatically reduce the processing overhead and the connection set-up delays as would be incurred by the connection-oriented mechanisms. Furthermore, the handover efficiency and the reliability is expected to be improved by means of IP tunnelling due to the dynamic routing capability of IP packets through the tunnels.

The detailed control procedures are being investigated.

8. Detail the message sequence charts showing the messages transported over the interface, and explain how this differs from the standard Abis message sequences.

The message sequences across the Abis interface are not affected by the IP tunnelling. The additional messages and the message exchange sequences are related to the set-up, maintenance and the release of the IP tunnel as well as the multiplexing/de-multiplexing operations of L3/L2 messages over the IP tunnel. Efforts are made to maintain an maximum openness of the message handling mechanisms between the L3/L2 functional layers and the IP tunnel layer so that further evolved mechanisms can be deployed.

9. Confirm that O&M is supported by the standardised interfaces and detail those interfaces.

Due to the simple fact that the IP tunnels provides a transparent bearer between the BTS and the BSC, and it incurs no changes over the specifications of existing interfaces except that an IP tunnel layer is added with a minimum set of control messages and control procedures, the existing O&M support over current standardised interfaces are least affected.

10. Detail the propagation delay between the BTS and BSC

The issues is currently being investigated.

11. Detail the management mechanism to support IP packet priority and pre-emption.

The existing packet prioritisation and differentiation as well as pre-emption mechanisms that have been or are being defined by IETF can be leveraged to the

most extent to achieve a flexible and effective IP packet priority and pre-emption. For example, explicit IP packet priority levels can be attached within the IP header and the associated pre-emption information is stored at the BTS and the BSC with the IP tunnel state records corresponding to each active IP tunnel. Another example is the DS fields as defined in DiffServ can be exploited to achieve the appropriate packet priority and pre-emption combined with managed queueing.

12. Detail the management of Quality of Service mechanisms and the support of real time traffic mechanisms; in particular,

(i) traffic classification
(ii) congestion management
(iii) congestion avoidance
(iv) queuing
(v) backhaul diversity

Because of the use of IP tunnels for traffic transport between BTS and BSC, existing IETF defined mechanisms such as DiffServ can be easily introduced for packet classification and QoS/CoS differentiation.

A simple model is that a Packet Classifier and Marker (PCM) and the Traffic Conditioner (TC) are attached at each end of the IP tunnel at BTS and BSC. According to some pre-defined and configured rules and policies, the PCM classifies the tunnelled Abis messages and mark the corresponding tunnelling IP packet with the appropriate DSCP. For each tunnelling IP packet, its DSCP is checked and then used to decide the corresponding forwarding priority and the expected traffic transmission characteristics to be achieved by the selected forwarding behaviour. An packet that exceeds the pre-negotiated QoS will be re-marked by the PCM to be either the Best-Effort Class or simply discarded by the TC.

Congestion Management is achieved by proper traffic conditioning through the TC via the means such as traffic shaping and policing.

Congestion avoidance is achieved by using the TC (shaping/policing) in combination with a three-way handshake (Request-Reply-Ack) mechanism that provides instant traffic processing and load information at each end of the IP tunnel.

Dynamic and flexible management of the IP tunnels can also facilitate the congestion control.

Separate queues are set up and configured and appropriate scheduling (CBQ, WFQ, RED) are deployed in combination with the PCM/TC/DSCP to guarantee efficient and effective traffic separation (signalling from the user data) and the QoS/CoS differentiation.

13. Explain how the IP Abis is backward compatible with the existing circuit switched Abis.

Efforts are made to guarantee maximum compatibility with the existing circuit switched Abis. Due to the nature of the transparent transport through the IP tunnels, the BTS (CCUs) and the BSC (PCUs) serve as the termination points for the IP tunnel where the Abis messages are extracted from the tunnelling IP packet and send to the circuits-switched Abis interface. No message change or protocol conversion is expected.

14. The Vendor shall state what BTS hardware and software releases will support an IP Abis.

The release with IP Abis interface is to be Release 2001 and beyond.